Erik 2024-09-06

Thursday, August 29, 2024 6:20 PM

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$$
$$\nabla \cdot \mathbf{B} = 0$$
$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$
$$\nabla \times \mathbf{B} = \mu_0 \left(\mathbf{J} + \varepsilon_0 \frac{\partial \mathbf{E}}{\partial t} \right)$$

Maxwellove rovnice
- zdroje
- rotácie

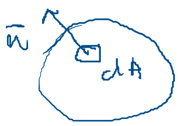
$$\operatorname{div} \vec{v} = \frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} + \frac{\partial v_z}{\partial z}$$

$$\vec{v} = \vec{v}(x, y, z)$$
$$\vec{\nabla} = i \frac{\partial}{\partial x} + j \frac{\partial}{\partial y} + k \frac{\partial}{\partial z}$$
$$v = i v_x + j v_y + k v_z$$

$$i^2 = j^2 = k^2 = 1$$
$$\vec{i} \cdot \vec{j} = 0 \qquad i\,(1, 0, 0)$$
$$\vec{i} \cdot \vec{k} = 0 \qquad j\,(0, 1, 0)$$
$$\vec{j} \cdot \vec{k} = 0 \qquad k\,(0, 0, 1)$$

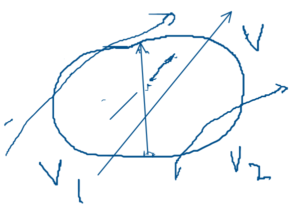
∂V

$$\Phi = \oint_{\partial V} \vec{v} \cdot d\vec{A} = \oint_{\partial V} \vec{v} \cdot \vec{n} \cdot dA$$



$$\operatorname{div} \vec{v} = \lim_{V \to 0} \frac{\Phi(V)}{V}$$

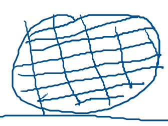
Φ



$\Phi(V)$

$$\Phi(V_1) + \Phi(V_2) = \Phi(V)$$

$$\sum \Phi(V_i) = \Phi$$
$$V_1 + V_2 + \dots = V$$



$$\int d\Phi = \Phi$$
$$\int \underbrace{\frac{d\Phi}{dV}}_{\operatorname{div} \vec{v}} dV = \Phi$$

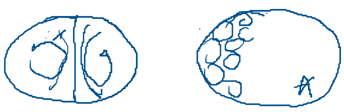
$$\boxed{\int_V \operatorname{div} \vec{v} \, dV = \oint_{\partial V} \vec{v} \cdot d\vec{A}}$$

$$\operatorname{div} E = \frac{\rho}{\varepsilon}$$

$$\int \operatorname{div} E \, dV = \frac{1}{\varepsilon} \underbrace{\int \rho \, dV}_{Q(V)}$$

$$\oint_{\partial V} E \, d\vec{A} = \frac{Q}{\varepsilon}$$

$$C(\ell) = \int_{\ell} \vec{v} \cdot d\vec{l}$$



$$\oint_A d\vec{C} = \oint \underbrace{\frac{d\vec{C}}{dA}}_{\operatorname{rot} \vec{v}} d\vec{A}$$

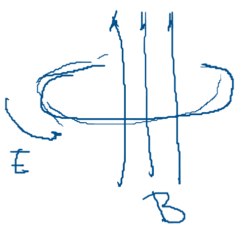
$$\sum_i C_i = C$$

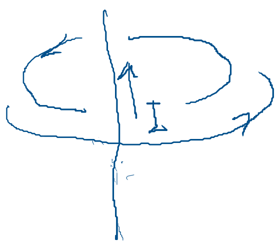
$$\operatorname{rot} \vec{v} = \lim_{A \to 0} \frac{C(A)}{A}$$

$$\operatorname{rot} \vec{v} = \vec{\nabla} \cdot \vec{v} = \begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ v_x & v_y & v_z \end{vmatrix} =$$

$$= i\left(\frac{\partial v_z}{\partial y} - \frac{\partial v_y}{\partial z}\right) - j\left(\frac{\partial v_z}{\partial x} - \frac{\partial v_x}{\partial z}\right) + k\left(\frac{\partial v_y}{\partial x} - \frac{\partial v_x}{\partial y}\right)$$

$$\oint_A \operatorname{rot} \vec{v} \, dA = \oint_{\partial A} \vec{v} \cdot d\vec{l}$$

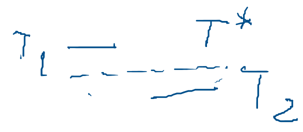


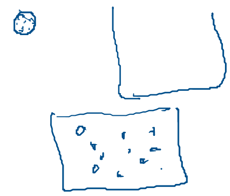


Termodynamika

Teplo

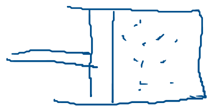
kontakt
žiarenie
veľký počet d.f.
spontánny proces





Práca

zmena ext. parametra



$V, P, B, \dots$

malý počet d.f.
kontrolovaný proces

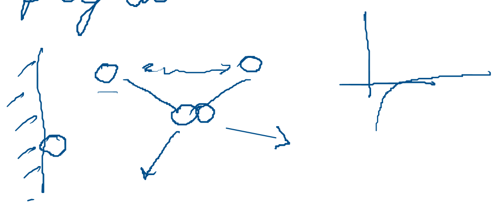
Teplota

miera horúcosti telesa

$\vartheta_2 > \vartheta_1$

Vzťah pre tlak ideálneho plynu

(Chceme stavovú rovnicu IP)



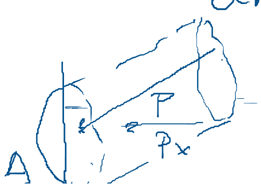
Pružný odraz od steny

Tlak plynu $= \dfrac{\text{sila}}{\text{plochu steny}} =$ $\qquad \Delta p = -2p_x$

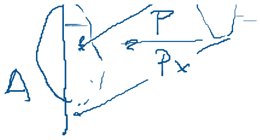
$$\ddot{a} = \frac{F}{m} \qquad F = m\ddot{a} = m\frac{dv}{dt} = \frac{dp}{dt}$$

$$mv = p$$

$$= \frac{dp}{dt \cdot A} \quad \text{tok hybnosti}$$



$$\underbrace{A v_x dt}_{\text{počet častíc}} \cdot \underbrace{\frac{N}{V}}_{\text{hustota}} \cdot \underbrace{\frac{1}{2}}_{\text{k stene}} \cdot 2 m v_x$$



$\ldots v_x \ldots$ počet častíc · V · Mistok k stene · 2 · $m v_x$

$\underbrace{\qquad\qquad}_{\text{celkový počet častíc}}$

$$P = \frac{1}{A\,dt}\left(A v_x\,dt\,\frac{N}{V}\,\frac{1}{2}\cdot 2 m v_x\right)$$

$$= 2\frac{N}{V}\underbrace{\frac{1}{2} m v_x^2} = \frac{2}{3}\frac{N}{V}\left\langle \frac{1}{2} m v^2 \right\rangle$$

$$\left\langle \frac{1}{2} m v^2 \right\rangle = \left\langle \frac{1}{2} m v_x^2 \right\rangle + \left\langle \frac{1}{2} m v_y^2 \right\rangle + \left\langle \frac{1}{2} m v_z^2 \right\rangle$$

$$\left\langle \frac{1}{2} m v_x^2 \right\rangle = \frac{1}{3}\left\langle \frac{1}{2} m v^2 \right\rangle$$

$$\left\langle \frac{1}{2} m v^2 \right\rangle = d.f \cdot \frac{1}{2} k_B T$$

ano

$$P = \frac{N}{V} k_B T$$

$$k_B = 1.381 \cdot 10^{-23}\ J/K$$

$$N = n N_A$$

$$P = \underbrace{\left(\frac{n}{V}\right)}_{c}\underbrace{N_A k_B}_{R} T = cRT$$

<u>Nabudúce Ut 18^{00}.</u>